TRAPEZIOMETACARPAL JOINT IMPLANT AND ASSOCIATED METHODS

CROSS-REFERENCE TO RELATED APPLICATION

The present application claims the benefit of French Patent Application No. FR0954190, filed on Jun. 19, 2009, and entitled "IMPLANT D'ARTICULATION TRAPÉZO-MÉTACARPIENNE," which is incorporated herein by reference in its entirety for all purposes.

BACKGROUND

Trapeziometacarpal prostheses and implants are designed to restore the strength and mobility of the anatomical joint of the thumb, between its metacarpal and the trapezium, when the joint is damaged by a degenerative or inflammatory pathological process. Many trapeziometacarpal prostheses are stem prostheses in which the metacarpal prosthetic component is anchored at one end in the metacarpal by an elongate stem while the other end of the prosthetic component is mounted pivotably either in a prosthetic component attached to the trapezium or in a cavity hollowed out in the trapezium. The implantation of these total or partial prostheses requires considerable cutting of the bone substance of the trapeziometacarpal joint and restores a ball-and-socket type of mobility which, from the point of view of kinematics, does not correspond to the mobility of the anatomical joint. Moreover, in the event of poor implantation, there are real risks of wear, luxation, or even prosthesis fracture. Some trapeziometacarpal implants without stems have also been proposed, those implants being implanted into a cavity or cavities formed in the trapezium and/or metacarpal. Often times, because of the compressive stresses applied to the implant body by the surrounding ligaments of the joint, the implant body gradually engages deeper in the bones, reducing the space between the bones and, consequently, their relative mobility.

SUMMARY

Some embodiments relate to a trapeziometacarpal implant that is permanently or semi-permanently implantable and provides mobility more similar to natural, anatomical mobility of the trapeziometacarpal joint. The trapeziometacarpal joint implant includes a body defining a metacarpal joint surface and a trapezium joint surface that are situated, at least in their central region, on either side of a median plane of the body. Each of the metacarpal and the trapezium joint surfaces correspond to a profile of an axial segment of a cylinder, a cone, or a torus, the axial segments of the cylinder, cone and/or torus being centered on respective axes which, as projected on the median plane, are substantially perpendicular to each other.

Some embodiments relate to a surgical method for fitting a trapeziometacarpal joint implant in which an articular area between the metacarpal and trapezium of a patient is accessed, the cortical bone surface of the trapezium is prepared so as to substantially match the trapezium joint surface defined by a body of an implant and, if need be, the cortical bone surface of the metacarpal is prepared so as to substantially match a metacarpal joint surface defined by the body of the implant, and the body of the implant is interposed between the trapezium and the metacarpal in such a way that an axis associated with the trapezium joint surface extends in either the antero-posterior or frontal plane of the patient, while an

axis associated with the metacarpal joint surface extends in the other of the antero-posterior or front planes.

Some embodiments relate to interposing between the trapezium and the metacarpal a relatively thin body (e.g., as opposed to a body that is voluminous and spherical or ellipsoid) with opposite joint surfaces which are concave at least in one direction and against which the cortical bone surfaces of the trapezium and of the metacarpal come to bear so as to roll and slide thereon. In order to reproduce the anatomical behavior of the saddle-type trapeziometacarpal joint, the two joint surfaces correspond to profiles of axial segments of a cylinder, cone and/or torus, of which the central axes or, more generally, taking account that the central axis of an axial segment of a torus is curved, the projections of these central axes on the median plane of the implant, are substantially perpendicular to each other.

In some embodiments, the body of the implant simulates the anatomical saddle-type trapeziometacarpal joint with the two joint surfaces. From the point of view of kinematics, the two, orthogonal joint surfaces of the implant body permit pivoting mobility about the two aforementioned central axes, in the manner of a cardan joint, or universal joint, to which the trapeziometacarpal joint is similar from a mechanical point of view. Moreover, the curvature of the two joint surfaces stabilizes and aligns the body of the implant between the trapezium bone and the metacarpal bone, thus avoiding the need to provide means of fixation to the bone(s). Moreover, by maximizing an area of contact between the implant and the bones of the trapezium and metacarpal in the area of the two joint surfaces, the implant body is adapted to reduce the likelihood of being forced into the bones, thereby retaining mobility of the joint.

In some embodiments, the body of the implant is minimized in thickness, where a range of thicknesses are optionally offered to a surgeon during implantation depending on a degree of wear of the joint that is being treated. Generally, the natural contours of the trapezium and metacarpal cortical bone surfaces are well-matched for cooperating with the joint surfaces of the implant. In cases of substantial wear, however, minimizing thickness of the implant helps minimize an amount of bone cutting required to match the mutually facing cortical bone surfaces of the trapezium and of the metacarpal to the joint surfaces of the body of the implant. In turn, for some trapeziometacarpal joints that are not greatly damaged, resection of the metacarpal can be minimal or even unnecessary. Typically, the size of the implant is selected such that the implant body is stabilized by the stress provided by the capsular and ligament envelope around the joint between the trapezium and the metacarpal, without the implant body being overstressed. For example, in some embodiments, the implant body retains a certain degree of freedom of movement to help the implant adjust its position, or adapt, as a function of the stresses of the articular envelope associated with the various possible movements of the trapeziometacarpal joint.

Various embodiments relate to a trapeziometacarpal joint implant having a trapezium joint surface and a metacarpal joint surface opposite the trapezium joint surface. In some embodiments, one or both of the metacarpal and trapezium joint surfaces correspond to a profile of an axial segment of a cylinder, a cone, or a torus having a cross section that is curved, curved inward along its entire periphery, elliptic, and/or circular. In some embodiments, the cross section associated with the metacarpal and/or trapezium joint surface has, in the central region of the joint surface, a smaller curvature than a remainder of the cross section and, if desired, in the peripheral region of the joint surface, a greater curvature than